



U.S. Department of Energy  
**Office of River Protection**

P.O. Box 450, MSIN H6-60  
Richland, Washington 99352

1248428  
(0066257H)

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07-WTP-011

Ms. Jane Hedges, Program Manager  
Nuclear Waste Program  
State of Washington  
Department of Ecology  
3100 Port of Benton Blvd.  
Richland, Washington 99354

Mr. Nicholas Ceto  
Hanford, INL Project Office  
309 Bradley Blvd. Ste 115  
Richland, Washington 99352

Addressees:

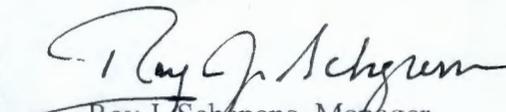
HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (HFFACO)  
(ALSO KNOWN AS TRI-PARTY AGREEMENT) INTERIM MILESTONE M-62-01, "SEMI-ANNUAL COMPLIANCE REPORT FOR THE WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP)," FOR JULY THROUGH DECEMBER 2006

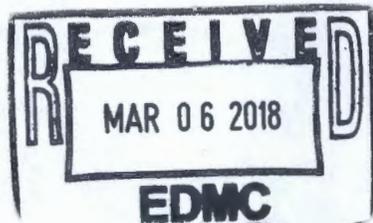
This letter transmits the U.S. Department of Energy, Office of River Protection, Semi-Annual Compliance Report (Attachment) required by Interim Milestone M-62-01 for the period July through December 2006.

As stipulated in the M-62-01 milestone, this report includes project summaries of accomplishments, issues encountered, and actions being taken.

If you have any questions, please contact me, or your staff may contact John R. Eschenberg, Waste Treatment and Immobilization Plant, Project Manager, (509) 376-3681.

Sincerely,

  
Roy J. Schepens, Manager  
Office of River Protection



WTP:BLN

Attachment

cc w/attach:  
C. M. Albert, BNI  
W. S. Elkins, BNI  
B. G. Erlandson, BNI (w/o attach)  
M. N. Jarayasi, CH2M HILL  
J. Cox, CTUIR  
S. Harris, CTUIR  
M. Anderson-Moore, Ecology (w/o attach)  
B. L. Becker-Khaleel, Ecology  
L. Cusack, Ecology

S. L. Dahl, Ecology  
G. P. Davis, Ecology (w/o attach)  
R. D. Morrison, FH - R. Puppo  
S. Leckband, HAB  
G. Bohnee, NPT  
K. Niles, Oregon Energy  
R. Jim, YN  
BNI Correspondence  
CH2M HILL Correspondence

Attachment  
to  
07-WTP-011

U.S. Department of Energy (DOE), Office of River Protection (ORP)  
Semi-Annual Project Compliance Report for the  
Waste Treatment and Immobilization Plant (WTP)  
July 1, 2006 – December 31, 2006

(Total pages 35 including the cover page)

**U.S. DEPARTMENT OF ENERGY (DOE)  
OFFICE OF RIVER PROTECTION (ORP)  
SEMI-ANNUAL PROJECT COMPLIANCE REPORT FOR THE  
WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP)  
July 1, 2006 – December 31, 2006**

**Office of River Protection**

**U.S. DEPARTMENT OF ENERGY  
OFFICE OF RIVER PROTECTION  
2440 Stevens Center Place  
Richland, Washington 99352**

**January 31, 2007**

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## LIST OF ACRONYMS

ABAR	Authorization Basis Amendment Request
AFA	antifoam agent
AIP	agreement in principle
ASME	American Society of Mechanical Engineers
BNI	Bechtel National, Inc.
BOF	Balance of Facilities
CAR	Corrective Action Request
CGD	Commercial Grade Dedication
CIO	Continuous Improvement Opportunity
DBVS	Demonstration Bulk Vitrification System
DCMA	Defense Contract Management Agency
DOE	U.S. Department of Energy
EAC	estimate at completion
Ecology	State of Washington Department of Ecology
EFRT	External Flowsheet Review Team
ERT	External Review Team
EVMS	Earned Value Management System
FPD	Federal Project Director
FY	fiscal year
HFFACO	<i>Hanford Federal Facility Agreement and Consent Order</i>
HGR	hydrogen generation rate
HLW	High-Level Waste [Facility]
HPAV	hydrogen in piping and ancillary vessel
IRP	Issue Response Plans
LAB	Analytical Laboratory
LAW	Low-Activity Waste [Facility]
LBL	LAW Facility, BOF, and LAB
LDB	leak detection boxes
LMI	LMI Government Consulting
NDE	nondestructive examination
NQA	Nuclear Quality Assurance
OECM	Office of Engineering and Construction Management
OEM	Office of Environmental Management
ORP	U.S. Department of Energy, Office of River Protection
OSHA	Occupational Safety and Health Administration
PJM	pulse jet mixers
PT	Pretreatment [Facility]
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RF	resorcinol formaldehyde
RGM	revised ground motion
RPP	River Protection Project
SQR	Supplier Quality Representative
TLFL	times to lower flammability limit
USACE	U.S. Army Corps of Engineers

UT            University of Texas at Austin  
VPP          Voluntary Protection Program  
WTP          Waste Treatment and Immobilization Plant Project

**U.S. Department of Energy, Office of River Protection**  
**River Protection Project – Waste Treatment and Immobilization Plant Project**  
**Semi-Annual Compliance Report**  
**Per Hanford Federal Facility Agreement and Consent Order Milestone M-62-01**

**1.0 INTRODUCTION TO M-62-01 – RPP – WTP PROJECT COMPLIANCE REPORT**

As required by the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (Ecology et al. 1989) Milestone M-62-01, this Semi-Annual Project Compliance Report (M-62-01M) reflects the status of the U.S. Department of Energy (DOE) Office of River Protection (ORP) Waste Treatment and Immobilization Plant (WTP) Project for the period of July 1, 2006, through December 31, 2006. As detailed in M-62-01, this report documents ORP's compliance with the HFFACO Milestone M-62-00 series requirements; updates WTP Project progress, activities, and issues relative to those milestones; and identifies activities expected in the near future.

**Hanford Site Background:** Hanford tank waste consists of approximately 190 million curies contained in 53 million gallons of mixed radioactive and hazardous waste stored in underground storage tanks at the Hanford Site in Richland, Washington. This tank waste will be remediated through treatment and immobilization to protect the environment and meet regulatory requirements. DOE determined through the "Record of Decision for the Tank Waste Remediation System, Hanford Site, Richland, WA" (62 FR 8693) that the preferred alternative to remediate the Hanford tank waste is to:

- Pretreat the waste to prepare it for processing and vitrification;
- Immobilize the low-activity waste for onsite disposal; and
- Immobilize the high-level waste for ultimate disposal in the national repository.

**WTP Complex Description:** The River Protection Project (RPP) WTP is a new waste treatment and immobilization complex being designed, constructed, and commissioned for DOE by Bechtel National, Inc. (BNI) at the Hanford Site under DOE Contract No. DE-AC27-01RV14136.<sup>1</sup> The WTP will be designed, constructed, and permitted to treat and immobilize radioactively contaminated waste to support the RPP mission.

The WTP complex will receive waste in batches from Hanford's double-shell tank system, operated by the Tank Farm contractor, through a pipeline system interface. The pretreatment process will separate (or continue to refine) the waste into low-activity waste and high-level waste fractions for vitrification. The vitrification process will combine pretreated tank waste with glass-forming materials and melt the mixture into a liquid that is poured into stainless steel containers. The hot glass cools and hardens, and each container will then be sealed in preparation for storage and permanent disposal. The dangerous waste and radioactive

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<sup>1</sup> Contract No. DE-AC27-01RV14136 between the U.S. Department of Energy and Bechtel National, Inc., dated December 11, 2000.

constituents will be destroyed, removed, or immobilized in this durable glass matrix through the WTP process. The immobilized low-activity containerized glass waste will be disposed on site and the immobilized high-level containerized glass waste will be disposed at the national repository.

The WTP complex waste-processing facilities include the waste-separating Pretreatment (PT) Facility, the glass-making High-Level Waste (HLW) Vitrification Facility, and the glass-making Low-Activity Waste (LAW) Vitrification Facility. These process facilities are supported by the WTP complex Analytical Laboratory (LAB) for process testing and the WTP Balance of Facilities (BOF) for infrastructure services.

This compliance report reviews each of the WTP Project functional areas, as well as the overall project. Financial data is through December 2006, unless otherwise noted. WTP Project status is also provided monthly through the Project Manager's Meeting and the Quarterly Milestone Review Meeting reports.

## **2.0 WTP PROJECT ACCOMPLISHMENTS AND ISSUES**

### **2.1 PROGRESS TO DATE**

#### **2.1.1 ORP – Project Management**

**Estimate at Completion (EAC):** On December 22, 2006, ORP gained DOE Headquarters approval of a new performance baseline of \$12.263 billion and completion date of November 2019 for the WTP Project. The cost to complete the project is \$8.62 billion and the project has already been appropriated \$3.64 billion for design and construction. The revised baseline assumes consistent Congressional appropriations of \$690 million from fiscal year (FY) 2007 through construction and commissioning completion.

To recap, the BNI December 2005 EAC represented a significant increase in both cost (\$3.37 billion) and schedule (5.75 years) from the March 2003 approved performance baseline. A U.S. Army Corps of Engineers (USACE) review team was engaged to perform a validation review of the December 2005 EAC. In addition, ORP had requested BNI conduct (1) a comprehensive review and analysis of the technical baseline focusing on the functionality of WTP process systems (External Flowsheet Review Team [EFRT]) and (2) a comprehensive review and analysis of the cost and schedule baseline (External Review Team [ERT]). BNI utilized the industry's most qualified people both within and external to BNI to perform the reviews. The technical review team's report, submitted to ORP on March 17, 2006, concluded that the process would work; however, the team had concerns about throughput capabilities and process efficiencies. The cost and schedule review team's report, submitted to ORP on March 31, 2006, concluded that the basic cost estimate and schedule were reasonable; however, the team thought that the project contingency was inadequate.

The December 2005 EAC was based on receiving \$626 million in funding for FY 2006, and the WTP Project only received \$526 million for FY 2006 (of which the contractor [BNI] received only \$490 million). ORP requested BNI prepare a second submission of the EAC to incorporate changes recommended from the industry experts and USACE reviews, as well as to reflect the effects of the actual FY 2006 contractor funding (\$490 million). BNI delivered an updated EAC to ORP on May 31, 2006, which reflected the above project changes. The May 2006 EAC

estimated the project would cost \$11.6 billion (not including contractor's fee), with an estimated completion date for hot commissioning of September 2017, and project completion date of August 2019 (including schedule contingencies).

On August 28, 2006, the USACE delivered to DOE its independent review of the May 2006 EAC, which provided a qualified validation of the EAC – with the addition of \$650 million, 3 months of schedule contingency, and funding presumption of \$690 million per year. An External Independent Review team, commissioned by the Department's Office of Engineering and Construction Management (OECM), conducted its review in late August 2006, and concluded that the proposed baseline update was "reasonably sound, defensible, and credible," but the report also identified one Major Finding, 12 Findings, and 25 Observations. ORP responded to these Findings and Observations in an October 20, 2006, "Corrective Action Plan." The corrective actions proposed by ORP were affirmed by a follow-up External Independent Review team visit. Based on these reviews, ORP formalized a proposal for the rebaseline of the project's performance baseline to \$12.263 billion, with a completion date of November 2019. The proposed performance baseline was approved by the Department's Secretarial Acquisition Executive on December 22, 2006. This approval provides ORP sufficient confidence in the project's technical, cost, and schedule estimate to serve as a firm foundation for the remainder of the project; allows contract negotiations with BNI to begin; and allows for continued discussions with the regulators regarding the WTP Project milestones.

In addition, on August 1, 2006, ORP directed BNI to continue with construction of the LAW Facility, BOF, and LAB (LBL), and defer startup of construction of the PT and HLW Facilities until FY 2008. This will allow for finalizing the seismic criteria for the PT and HLW Facilities and resolving many of the technical issues for the PT Facility in FY 2007. This will also allow for the continued construction of the LBL for completion by the end of FY 2012.

**Safety Record:** From project inception through the end of November 2006, WTP employees have worked in excess of 31 million hours with only 189 Occupational Safety and Health Administration (OSHA) recordable injuries. The cumulative OSHA recordable injury rate for the entire project since inception is 1.2 injuries per 200,000 hours worked. By comparison, the OSHA recordable rate for the construction industry nation-wide is 5.6 injuries (by the Bureau of Labor and Industry as of December 2005), and for DOE construction contractors, 2.2 injuries.

On July 14, 2006, BNI hosted the second installment of their Construction Safety Leadership Alliance series, "Continuing the Journey," for the construction work force. The event was a continuation of the team's successful Safety Alliance rally held on October 7, 2005, where employees announced their intent to apply for DOE's Voluntary Protection Program (VPP) star status. The project's VPP steering committee hosted the rally with support from BNI, the Central Washington Building and Construction Trades Council, and DOE ORP to honor worker safety and nuclear quality construction. Nationally recognized Conversations and Human Performance Improvement speakers, Al Switzler and Shane Bush, delivered motivational discussions on outstanding communication, decision-making processes, and the journey to positive working environments.

The WTP construction site workforce has been working toward the achievement of the DOE-VPP Star Status over the last five months. In that time, considerable strides have been made toward the improvement of the current programs and processes, as well as the development of the application. The WTP-VPP Steering Committee has been instrumental in exposing the workforce to the five tenets of DOE-VPP and associated sub-elements.

Once the workforce was familiar with DOE-VPP, the steering committee initiated its preliminary self-assessment of the programs and processes found on the WTP construction site. Approximately 25% of the construction site workforce was also interviewed during the self-assessment. The data gathered from this preliminary self-assessment enabled improvement opportunities to be identified and illustrated where alignment existed between the various organizational levels at the construction site (i.e., Senior Management, Line Management, Craft, Non-Manuals, and Subcontractors). The opportunities for improvement were captured in a safety improvement plan.

Currently, the WTP-VPP Steering Committee is focusing its efforts on two areas that will help the WTP construction site workforce progress toward the submittal of its application. First, the steering committee is addressing the high-priority items found within the safety improvement plan. The steering committee is also in the process of assembling the first draft of the DOE-VPP application. In future months, the WTP construction site workforce will continue improving its programs, processes, and culture in preparation for the submittal of its DOE-VPP application.

### **2.1.2 WTP Complex Design and Construction**

**Project Overview:** Design, procurement, and construction activities continue at the LAW Facility, BOF, and LAB (LBL). Design, limited procurement and site maintenance are continuing at the PT and HLW Facilities. Construction on PT and HLW Facilities was halted by the end of FY 2006, pending resolution of seismic issues. For FY 2007, Congressional restrictions were placed on seismic-related procurement and construction activities of PT and HLW Facilities until the Secretary of Energy certifies to the Congressional defense committees that the final seismic and ground motion criteria have been approved by the Secretary, and that the WTP Project Contracting Officer has formally directed that the approved seismic criteria be used for the final design of the PT and HLW Facilities. Consequently, the sequence of WTP activities has been changed to accelerate the design and construction of the LBL, and to delay construction of the PT and HLW Facilities, while design for these two facilities is advanced. This approach will create a larger design backlog (the time between completion of design and start of construction of a given facility component) for the PT and HLW Facilities. Design for the WTP project is 78% complete and construction is 29 % complete (based on hours). An average of 740 personnel (439 craft and 301 non-manual staff) was working on site, down from a peak of about 2,050 personnel in March 2005. For FY 2007, a second Congressional restriction was placed on the amount of funds that can be utilized for the WTP Project, pending a recommendation by the Defense Contract Management Agency (DCMA) to approve the contractor's Earned Value Management System (EVMS), and subsequent approval by the Secretary. DCMA conducted a certification audit of the contractor's EVMS in late November 2006.

**Pretreatment Facility:** The primary focus for the PT Facility has been resolving issues related to the EFRT findings, and changing the construction sequence for the five WTP facilities,

The LBL construction activities will continue next year rather than be curtailed as planned in the May 2006 EAC. This approach will allow the PT design team to resolve issues that were raised primarily by the EFRT, resolve seismic design issues, and build a backlog of design in preparation for resumption of construction. When preparing the resequencing schedule, BNI shifted the PT activities out in time as a block without changing the internal relationships. In December 2006, PT staff started to optimize the schedule with the goal of completing the revision by the end of March 2007. This activity will also add the additional work associated with resolving the issues raised by the EFRT.

The EFRT identified 17 major issues and 11 potential issues. In response to these issues, BNI developed Issue Response Plans (IRP) for each of the major issues. DOE reviewed and approved the IRPs as they were completed. All IRPs are now complete and BNI is in the process of implementing the plans. It took several months longer to complete the IRPs than planned because DOE comments were more extensive than BNI had originally anticipated. Also, the testing work associated with the IRPs will confirm engineering value developed through analysis for the most part; this will allow design work to proceed in the near future.

Civil/Structural Engineering continues to work on the concrete walls and slabs as time is available. The LBL Facilities have priority; therefore work on the PT Facility fills gaps in the LBL schedule. Civil/Structural Engineering completed the rebar design for sections of the 56' elevation slab and wall sections for the 56' to 77' elevation walls, ahead of schedule.

Mechanical Systems has been deeply involved in developing the IRPs, associated with the EFRT comments. Since many of the EFRT issues involve the PT Facility, it is critical that they be resolved quickly, so that PT Engineering can resume activities with confidence in the sound technical basis of their work.

In September 2006, BNI recommended that the baseline cesium ion exchange resin be changed from Superlig® 644 to spherical resorcinol formaldehyde (RF). DOE approved RF as an equivalent resin. As design authority, BNI will determine which of the two resins is best suited for the waste and operation of the facility, while taking into account the cost and schedule impacts associated with each resin.

Mechanical Handling has proposed replacing three jib cranes in the PT hot cell with a second bridge crane. The proposed second bridge crane would operate only in the remote decontamination and maintenance area of the hot cell. This change would resolve some issues associated with maintenance of the jib cranes, and would also improve the availability of the main hot cell crane for operations in the hot cell.

Construction was suspended in December 2005 with minor exceptions. Stairways up to the 56' elevation are being installed along with some minor stairways within the building. These permanent stairways will take the place of the scaffolding stair towers that were put in place during construction and will improve the safety of the facility now and after construction is resumed.

Procurement activities have remained at a fairly low level because of: (1) Congressional restriction on procurement of critical equipment that requires seismic design; (2) impacts from the resolution of recommendations and issues by the EFRT; and (3) impacts from hydrogen in piping and ancillary vessel (HPAV) issues. The hot cell fabrication and factory acceptance testing were satisfactorily completed at the vendor's facilities. The process vessel fabrication has been limited to installation of cooling water jackets. Restrictions were placed on vessel fabrication by the Washington State Department of Ecology (Ecology), while issues with wear plate thicknesses are being resolved.

**Low-Activity Waste Vitrification Facility:** All three air handling units have been installed at the 48' elevation. These are the large C2 ventilation air handling units that support the entire facility. The process cell shield doors have been installed. These doors provide personnel protection against direct radioactive shine from the feed and offgas vessels, during normal operations. All of these vessels can be decontaminated to allow personnel entrance into the space for maintenance, via the shield doors. Placement of the walls for the container export bay, as well as the shielding wall, has started and construction activities are being performed to complete all walls.

LAW Construction is being hampered by several issues that prevent the ordering, delivery, and receipt of components. Processes and procedures for the Commercial Grade Dedication (CGD) of material are taking longer to prepare and are more difficult to implement than was expected. The availability of Civil, Mechanical Systems, and Plant Design Engineers is also hampering Construction's ability to quickly resolve issues. BNI is working to resolve the shortage of engineers, which have resulted in increased schedule delays.

The long-awaited fire test of the W14×90 column with intumescent coating was performed on October 5, 2006, and all three W14×90 samples failed the test. BNI is proceeding with the removal of intumescent coating on all W14×90 columns to allow application of cementitious coatings.

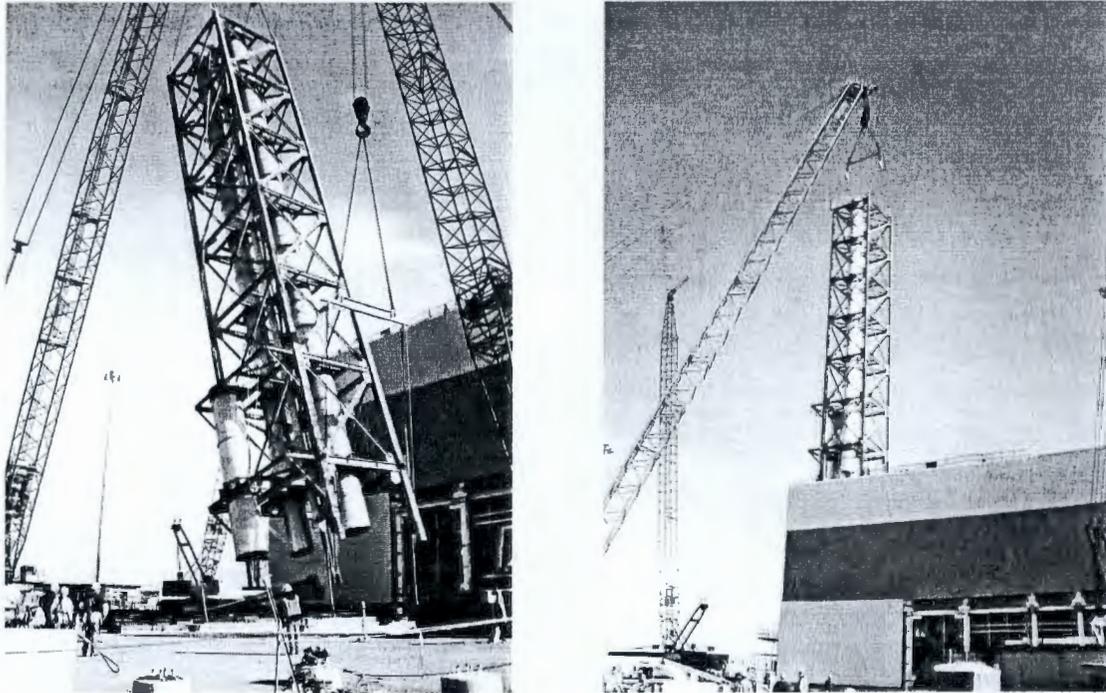
Construction forces installed the exhaust stack (Figure 1), which is approximately 130 feet long and contains the piping for the C2, C3, and C5 ventilation systems discharge. There was a multi-week planning effort to ensure that all construction, engineering, and safety issues were resolved. The LAW Facility is now 198 feet high.

LAW Construction has declared the facility dried in. The main facility siding and all the roofing material have been installed, excluding a construction opening and the roof under the stack, respectively. Construction forces are installing rain barriers on the container export bay and the melter bays to minimize water intrusion.

Construction is proceeding on a number of fronts. Millwrights are aligning the monorails in the #1 and #2 melter pour caves. Piping and hanger and scheduled conduit installation are proceeding on the -21' and 3' elevations. At the 3' elevation, the installation of ventilation offgas ducting and support, slab dowels, and conduit for the container export bay is proceeding, along with the setting and welding of towers. Sheetmetal for the assembly of the 28' elevation gloveboxes is being set-up and cable tray is being installed. Fireproofing, ventilation ducting, and insulation are being installed on the 3' and 28' elevations. Rebar curtains for container

export bay north wall (between the 28' and 48' elevations) are being installed. Ventilation inlet louvers and sheet metal to support the installation of the air handling units is being installed on the 48' elevation. Decking support is being installed around the stack and roof flashing is being installed at the 68' elevation. Removable hand rails are being installed on the platforms outside the north and south container decontamination bays. Downspouts are being installed on the north side of the facility.

**Figure 1. LAW Exhaust Stack**



**High-Level Waste Vitrification Facility:** Construction on the HLW Facility has been suspended since January 2006 to allow analysis of the structures, systems, and components and to perform the redesign that incorporates the revised ground motion (RGM) criteria. The RGM increased the magnitude of the design earthquake by 40%. The only ongoing construction activity has been the application of special protective coatings for concrete slab and walls at the (-) 21'-0" elevation.

No changes are required to the design of the facility below the 0' elevation. Analysis shows that upper levels of the facility require structural modifications due to the increased earthquake-induced motions.

The design priority for HLW has been to complete sufficient concrete and piping design, thereby creating a significant backlog for procurement and construction. In addition, in light of the restriction in funding in the construction of RGM-related elements, the project is evaluating whether to expedite future-year procurements to offset spending shortfall against the funding

level for 2007. Both HLW and PT Engineering have obtained additional personnel from various BNI offices to support the key design efforts.

In December 2006, the dynamic analysis of the HLW Facility was revised to incorporate the stiffened roof steel structures, thereby reducing the high seismic accelerations that resulted from the previous analysis with the RGM. Redesign of concrete slabs at the 0'-0" elevation has been completed. Walls from 0'-0" to 14'-0" elevations are being redesigned to incorporate RGM. All the piping and instrumentation drawings for HLW (except the Autosampling System [ASX]) have been issued as committed system design packages. Engineering review of the equipment layout drawing for elevation 58' elevation has been completed. Piping for the Instrument Service Air (ISA) System for Planning Area 11 (corridor at 0' elevation) has been issued.

Wet Electrostatic Precipitators (WESP), 480V Load centers, and 15 pieces of equipment related to the remote HLW Canister Decontamination Swabbing System have been received at site. Canister decontamination swabbing equipment includes robotic manipulator, canister turntable, and swabbing tools. The engineering and fabrication for shield doors had to be transferred to a new vendor, Oregon Iron Works, to complete the unfinished activities of the previous fabricator (Unidynamics Corp), who declared bankruptcy in 2006.

BNI Engineering has started using the newly developed design criteria and desk instructions to resolve technical issues identified earlier in 2006 in the design review of the "joggles." The design review is scheduled to be completed in January 2007.

ORP and BNI are in the process of developing formal comments in response to the revised draft of the Dangerous Waste Permit recently released by Ecology.

DOE completed the HFFACO milestone M62-03, Submit DOE petition for *Resource Conservation and Recovery Act of 1976* (RCRA) delisting of vitrified HLW on December 31, 2006.

**Balance of Facilities:** Construction forces are removing the LAW Tower Crane for future use at the Savannah River Site to support the construction of the MOX Facility.

BNI Field Engineering and BOF Construction have developed an approach to resolve the piping slope issues with the underground LAW piping south of the PT Facility. This piping must have a minimum 0.5% negative slope to ensure any leakage is returned to the PT Facility. Several pipes were found to have slopes less than 0.5%. The pipe with the worse slope, a 0.345% positive slope, is the test pipe for the proposed repair process. BOF Construction will be cutting the external containment pipe at two locations and rotating the pipe through two axes. BNI Field Engineering has determined that this approach will allow the pipe to meet minimum slope requirements. This repair process requires only cutting and re-welding the external containment piping; the internal pressure piping is not affected.

Fit-up of the WTP discharge line to the Hanford Site Liquid Effluent Retention Facility (LERF) on the northwest side of the WTP site has been completed.

The Glass Former Storage Facility basemat has been placed. This required 1,000 cubic yards of air entrained concrete, which is the type of concrete used when the area will be exposed to cold weather.

**Analytical Laboratory (LAB):** The last basemat concrete placement was completed to support the installation of structural steel. Structural steel installation is progressing, with sufficient structural steel on site to support 11 weeks of work. If current supply and construction schedules hold, the structural steel erection should be completed by May 2007.

Construction forces performed cement finish work inside the hot cell to support the installation of stainless steel lining and protective coatings. Structural steel has been installed in the cell C2/C3 area. Piping installation is progressing in the C3 cell. Construction forces are welding beam clips in the C5 cell to support the installation of concrete decking above the cell.

**Commodities Installations:** Based on the construction activities, the total WTP Project commodities placed or installed as of December 2006 are summarized in Table 1.

**Table 1. Key Commodity Quantity Progress**

Quantity Progress	Current Planned at Completion Quantity	Installed To-Date Through December 2006	Percent Complete
Concrete	256,180 cy	166,280 cy	65%
Structural Steel	34,575 ton	8,617 ton	25%
Piping (aboveground)	868,710 ft	83,300 ft	10%
Piping (underground)	112,155 ft	103,730 ft	92%
Conduit (aboveground)	664,510 ft	77,330 ft	12%
Conduit (underground)	187,315 ft	158,050 ft	84%
Cable Tray	96,300 ft	11,970 ft	12%
Cable and Wire	4,271,950 ft	176,500 ft	4%
Heating, Ventilation, and Air-Conditioning Ductwork	4,111,925 lb	501,550 lb	12%

### 2.1.3 Environmental Permits Required for Start of Construction

**Permitting and Licensing:** DOE and BNI continue to work closely with state and federal regulatory agencies to maintain permits, licenses, and authorizations needed to support WTP construction and commissioning. Permits required to support construction are in place. Permit modifications and revisions on evolving engineering designs are required and submitted on an ongoing basis. Non-radioactive and radioactive air permit applications containing updated design information have been approved: The Washington State Department of Health approved the radioactive air permit in June 2006, and the Washington State Department of Ecology approved the non-radioactive air permit in December 2006.

Ecology also approved nine Dangerous Waste Permit modifications during this reporting period. In October 2006, Ecology released a proposed permit modification to reflect the 2+2 melter design and other changes. Ecology also stated their intent to deny ORP and BNI's request to eliminate the technetium removal system from the Dangerous Waste Permit. The public comment period ends January 5, 2007, and ORP and BNI are planning to provide comments on selected changes proposed by Ecology.

The Dangerous Waste Permit includes a compliance schedule (*Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion*, Chapter 10, and Attachment 51, "Waste Treatment and Immobilization Plant" [Ecology 2004]) that requires the submittal of engineering and operational information. Commodity growth, performance deterioration in engineering and construction, hydrogen buildup in piping and vessels in the PT Facility, difficulty in mixing heavy fluids in the PT Facility, revised seismic criteria affecting structural design of the PT and HLW Facilities, and a reduced FY 2006 funding level all contributed to increased project costs and schedule extension. In the December 2006 approved baseline, the estimated completion date for hot commissioning is May 2019. As a result, the compliance schedule items listed in Table 2 will not be met.

**Table 2. Dangerous Waste Permit (RCRA)  
Compliance Schedule Items (2 pages)**

Item Number	Description	Due Date
1.	Submit documentation stating the WTP has been constructed in compliance with the Permit.	03/01/2008
3.	Revise and Submit Waste Analysis Plan and associated Quality Assurance Project Plan to Ecology for review and approval.	04/01/2007
4.	Update and submit for approval "Procedures to Prevent Hazards," Chapter 6.0, Sections 6.3, 6.4, 6.5, and the Inspection Schedule.	04/01/2007
5.	Update and submit the Contingency Plan.	04/01/2007
6.	Update and resubmit for review and approval Training Program description in Chapter 8 of the Permit.	04/01/2007
7.	Submit under separate cover the actual WTP Dangerous Waste Training Plan for incorporation into Administrative Record.	04/01/2007
8.	Update and resubmit the Closure Plan for approval.	04/01/2007
11.	Submit descriptions of container management practices.	04/01/2007
15.	Submit descriptions of tank management practices.	04/01/2007
17.	Submit descriptions of containment building management practices.	04/01/2007

**Table 2. Dangerous Waste Permit (RCRA)  
Compliance Schedule Items (2 pages)**

Item Number	Description	Due Date
21.	Submit descriptions of management practices for the Pretreatment Miscellaneous Treatment System.	04/01/2007
25.	Submit descriptions of management practices for the LAW Vitrification Miscellaneous Treatment System.	04/01/2007
30.	Submit descriptions of management practices for the HLW Vitrification Miscellaneous Treatment System.	04/01/2007
32.	Final Compliance Date.	02/28/2009

ORP is in the process of working with the regulators to resolve the HFFACO and *Resource Conservation and Recovery Act of 1976* (RCRA) permit compliance issues.

## 2.2 NEAR-TERM ISSUES

### 2.2.1 Regaining Confidence in Project Baseline

Since late 2005, seven different reviews, both internal and external, of WTP cost and schedule projections and cost management systems have been conducted. The findings and observations from these reviews have been either resolved or well underway. This provided the Secretarial Acquisition Executive with sufficient confidence in the WTP project to approve rebaselining of the project on December 22, 2006. The total project cost of the new performance baseline is \$12.263 billion and the completion date is November 2019. The cost to complete the project is \$8.62 billion and the project has already been appropriated \$3.64 billion for design, procurement, and construction. The revised baseline assumes consistent Congressional appropriations of \$690 million from FY 2007 through construction and commissioning completion.

The details of the rebaseline will be outlined in the FY 2008 Departmental budget request. Early discussions have taken place with the regulators concerning the impact of the rebaseline. Contract negotiations with BNI will commence in the spring 2007.

### 2.2.2 Earned Value Management System Certification

In December 2004, DOE requested BNI become certified to the American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA)-748, *Earned Value Management Systems* criteria, and that a DCMA readiness review be conducted. The initial DCMA EVMS certification review conducted in June 2005 concluded the BNI EVMS description and implementing procedures were non-compliant with the ANSI/EIA-748. Due to the substantial cost growth experienced in FY 2006 for the WTP, Congress specified a 10% budget holdback in the FY 2007 authorization statute, pending DCMA's recommendation to accept BNI's EVMS as

compliant with ANSI/EIA-748. To assist in achieving EVMS certification, BNI retained expert resources in earned value management. Extensive training of BNI personnel and modification of the project control system description and implementing procedures were followed by several mock reviews by independent BNI corporate and consultant personnel. DCMA completed the follow-on certification review in late November 2006. Though DCMA noted significant improvement, the review resulted in the identification of eight Corrective Action Requests (CAR), three major and five minor, and three Continuous Improvement Opportunities (CIO). BNI is in the process of preparing a corrective action plan that addresses the CARs and CIOs; the corrective action plan is forecast to be transmitted to DCMA by February 20, 2007.

### **2.2.3 Intumescent Structural Steel Fire Coating Design Issue**

In the 2003 and 2004 timeframe, BNI proposed to minimize the use of coatings for protection of structural steel against potential fires at WTP. In an October 17, 2005, letter to DOE, the Defense Nuclear Facilities Safety Board (DNFSB) identified issues related to BNI's proposal (DNFSB 2005). After that letter was issued, BNI changed its approach to focus on preparing a technical basis for meeting applicable building code requirements related to fireproofing structural steel. The approach focuses on providing fire protection for selected structural steel members based on their role in supporting the structure during and after a fire, instead of protecting every member. This strategy is acceptable if it can be reasonably shown that unprotected structural members with reduced material properties due to a fire would not be relied upon to support the building. BNI continues to prepare implementation of the appropriate structural design criteria to address this strategy. For the strategy to be effective, DOE and BNI must understand precisely how loads are distributed throughout each facility and account for degradation of the steel's material properties as the result of a fire. In addition, the project will also protect structural steel so that the failure of structural steel in the non-critical areas, due to credible fire in those non-critical areas, would not cause the structural shell for the critical areas to lose its confinement capability, or to impact important-to-safety structures, systems, and components.

BNI delivered a proposed methodology and example structural calculations for the LAW and LAB Facilities to the DNFSB in October 2006. To address the detailed concerns of DNFSB staff, BNI is conducting additional analyses, including analysis of changed conditions to unprotected members, when unprotected members are considered ineffective and how structural stability is maintained. This additional analysis will be available for review by the end of January 2007 for the LAW Facility and discussed at a conceptual level during the DNFSB's January 2007 visit.

In addition to which structural steel members require protection, issues also exist with the application of fire protection coatings within the LAW Facility as discussed below.

**Technical pedigree for use of special coatings.** Some LAW coating designs, using a material that swells when exposed to heat (intumescent) were proposed for numerous structural steel members. However, for small-size structural steel columns in the LAW Facility, the intumescent coatings lacked an accredited tested technical basis for coating thickness as necessary to achieve a 2-hour fire resistance rating per American Society for Testing and Materials (ASTM) requirements. To address the technical design basis, the manufacturer of the intumescent

coatings attempted a qualification fire test at an Underwriters Laboratory to demonstrate a required 2-hour rating. In late September 2006, the test was conducted but failed to achieve a 2-hour rating. Due to the fact that construction on the LAW Facility could no longer be delayed for additional fire testing, the project decided to protect the smaller structural members in the facility with an alternative cementitious protection method that had already been certified as meeting a 2-hour rating.

**Repair of damaged intumescent coatings in the LAW Facility.** Intumescent fire protection coatings applied to steel members at elevations levels below 48 feet in the LAW Facility were damaged by rains during the winter of 2005/2006. With the assistance of the intumescent coating manufacturer, a repair process was developed for accessible members using the intumescent material. In addition, damaged LAW intumescent coatings were removed on perimeter members to support siding installation. Now that the LAW siding and roofing has been completed and the building is secure from the exterior environment, interior intumescent repairs have been occurring.

ORP also directed the WTP contractor to develop a comprehensive plan and schedule to address fire coatings on the other WTP facilities so a sound technical strategy is in place to ensure fire coatings compliance is incorporated into remaining WTP facility design. The contractor has initiated a three-phase process that includes (1) identifying members in remaining WTP facilities which require coatings; (2) determining if certifications existing for the specific member sizes and shapes; and (3) where no certifications exist to either modify the steel design for a size which has a certified listing, using an alternative coating material, conducting an engineering evaluations, or conducting a fire test. ORP has requested the contractor complete a comprehensive plan and schedule to address a path forward on the coatings by the end of January 2007.

#### **2.2.4 Revised Ground Motion**

Implementation of the RGM response spectra in the design of WTP structures, systems, and components is ongoing. BNI continues with the design of PT and HLW Facilities concrete structures, piping, and equipment for the RGM. Thus far, none of the concrete structures required modifications; however, a number of vessels and piping systems required some modifications resulting from the design to the RGM. Design of PT Facility is resolving technical issues, such as HPAV and multiple overblow loadings. HLW has completed re-evaluating the slab at the 0'-0" elevation and structural steel framing for the slab at the 14'-0" elevation. Re-evaluation of HLW walls between elevations 0'-0" and 14'-0" is ongoing. Re-analysis of piping is ongoing for below 14'-0" elevation. Vessel redesigns for RGM are behind schedule due to delays in the incorporation of various technical issues raised by the DOE Peer Review Team and USACE, as well as issues raised by BNI reviewers.

The program for the drilling of deep boreholes to a depth of 1,500 ft to obtain soil characterization data is going well. Drilling of all four holes was completed in November 2006. Downhole seismic logging for compression (P) and shear (S) wave at various depths by the University of Texas at Austin (UT) and Redpath Geophysics personnel using UT T-Rex vibratory source, and the Lawrence Berkeley National Laboratory wireline truck and downhole geophone was completed in December 2006.

Pacific Northwest National Laboratory issued the *Borehole Summary Report for Core Hole C4998* (PNNL-16303), describing the drilling of the corehole and documenting the geologic data collected on December 21, 2006. A draft report for the seismic velocity is scheduled to be issued in late January 2007. The site response report is scheduled to be issued on May 30, 2007.

### **2.2.5 Pulse Jet Mixers Design Closure**

Three areas of pulse jet mixer (PJM) design are undergoing additional design review and testing: (1) to firm up data regarding system performance; (2) to close out unverified assumptions regarding system design; and (3) to resolve issues identified by the EFRT.

- Previous PJM testing was focused on ensuring that hydrogen gas does not accumulate in individual pulse jet tubes in excess of the lower flammability limit. The current PJM air usage strategy assumes the antifoam, added due to sparging the non-Newtonian tanks, will not increase the gas retention of these vessels. The initial testing at Savannah River National Laboratory demonstrated that this assumption was not bounding in most cases, and that additional testing would be required. Prototypical testing is being planned to quantitatively evaluate this effect. Also, alternative antifoam agents will be reviewed. The purpose for this second phase of antifoam activities is to minimize the impact of antifoam behavior on plant systems.
- Testing to demonstrate that full-stroke PJM mixing fully exchanges the slurry within the PJMs (ensuring flammable gases do not accumulate in individual pulse jet tubes) has been completed. An extension to this test program to determine the minimum PJM strokes was successfully accomplished, and the test report was issued for review.
- Testing to demonstrate PJM overflow, and, to show when the PJMs are full, using the pressure measurement instruments, has been completed. Methods were developed for overflow detection, which are being incorporated into the plant design. The tests indicate that the current method for determining that the PJMs have been filled with slurry prior to "driving," will be successful. Follow-up testing to determine design loadings for multiple PJM overflows, and to firm up instrument and control performance for full-size PJMs is slated to begin in January 2007. Initial scoping tests were performed in November 2006 to firm up test instrumentation selection and performance.
- New PJM testing is currently being planned to address concerns identified in the EFRT review of WTP. The work is defined in the EFRT Issue Response Plans (IRP) for issue M3, Inadequate Mixing. PJM testing activities will be performed in scaled mixing platforms to: (1) demonstrate re-suspension of settled waste solids of Newtonian slurries; (2) determine mixing times for various vessel mixing functions; (3) determine if a hydraulic "short circuit" could occur in non-Newtonian slurries, which would cause insufficient mixing; (4) confirm post-design basis event mixing of vessels; and (5) demonstrate that normal process mixing successfully meets the flowsheet mixing requirements. The schedule for the various related activities is detailed in the M3 IRP.

### 2.2.6 Hydrogen Generation

On January 12, 2006, DOE sent a letter to BNI (05-WED-054, CCN 134669, "Design Oversight Report for the Revised Hydrogen Generation Rates [HGR] and Times to Lower Flammability Limit [LFL] Calculation [24590-WTP-M4C-V11T-00004]"). In the letter, DOE stated it did not feel the referenced HGR and times to lower flammability limit (TLFL) calculation was adequate to support its use as the WTP design basis, due to incomplete supporting analyses based on 13 open items identified during the ORP design oversight. The letter required a response from BNI that would provide an action plan for resolution of the open items; the response was required within 30 days.

On March 14, 2006, BNI sent letter CCN 106655, "Hydrogen Generation Rate Calculation Open Items," to DOE, which addressed and responded to each of the 13 open items. The letter also addressed the subject of issuing a revised HGR and TLFL calculation in a confirmed status. The letter stated the calculation was expected to be issued on May 10, 2006.

On May 18, 2006, *Calculation of Hydrogen Generation Rates and Times to Lower Flammability Limit for WTP*, 24590-WTP-M4C-V11T-00004, Rev. C, was issued as a committed calculation. The calculation was not confirmed because Authorization Basis Amendment Request (ABAR) 04-197, "Implementation of Revised Time Basis for Single Failure Criteria for Hydrogen Mitigation," referenced by the HGR calculation, was not yet approved. DOE is currently completing its review of ABAR 04-197 before the HGR and TLFL calculation is issued in confirmed status. In addition, several design modifications are being reviewed by DOE and BNI to improve the capacity of the WTP. These potential modifications may impact the HGR calculation and may be included in the calculation prior to its release as confirmed.

### 2.2.7 Issues with Use of Antifoaming Agent in WTP Pretreatment Vessels

During design of the WTP Pretreatment Facility, seven tanks were projected to contain non-Newtonian slurries. Mixing of these complex fluids is required for processing and to prevent hazardous volumes of flammable gases generated by radioactivity and chemical reactions. PJMs are planned for mixing most vessels in the WTP because they contain no moving parts; however, testing indicated their effectiveness for non-Newtonian fluids was low. Air spargers were therefore added to promote better mixing.

Antifoam agents (AFA) are planned for use in the WTP evaporators and the tanks with non-Newtonian fluids. AFA works to eliminate foaming by reducing surface tension. This was successfully demonstrated in the evaporator testing. Past tests have indicated that the AFA also works to decrease the size of gas bubbles in liquids. A recent study<sup>2</sup> indicates that the AFA creates smaller gas bubbles in liquids. In the WTP, the small gas bubbles are created by hydrogen generation due to radiolysis of water or from sparge air used to mix the non-Newtonian tanks. The smaller bubble size leads to a lower rise velocity (due to buoyancy) and therefore the release rate for a given volume of gas from a tank can be reduced. (It should be noted, however,

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<sup>2</sup> SRS 2006, *Ultrafiltration Process (UFP) Caustic Leaching Antifoam Performance*, WSRC-TR-2005-00564, Rev. 0, Savannah River National Laboratory, Aiken, South Carolina.

that the hydrogen generation rate is not influenced by the addition of AFA.) While the tests indicated smaller bubbles and slower release rates, the test apparatus was not prototypic of the WTP systems. A lower release rate means that the tanks would have to be mixed more often and longer to release the gas. This more frequent and longer mixing could lead to increased air supply and ventilation requirements. If more gas is held up in the liquids during normal operations, the issue could be resolved by increasing the mixing frequency, lengthening the mixing duration, or reducing tank operating levels (to increase the vapor head space). If incomplete gas release is verified with the current design-basis event mixing strategy, mixing frequency and durations may have to be increased. The AFA test program has been developed and is currently being internally reviewed. The primary objective of this program is to provide a technical basis for predicting gas retention and release and mass transfer in WTP vessels with AFA additions. The tentative schedule calls for testing to be completed by August 2007, and the draft report to be issued by September 2007.

### **2.2.8 Hydrogen in Piping and Ancillary Vessels**

BNI has been investigating the buildup of HPAV and developing methods for preventing hydrogen from accumulating in quantities sufficient to cause damage to affected systems. Engineering found that similar conditions existed in a number of locations throughout the facilities. Rather than develop an active mitigation design for each location, they developed a generic design solution that would be applicable at each location. Ultimately, there were nearly 20 generic solutions developed to address the different conditions. Once the generic solutions had been developed, BNI chartered a Hydrogen Review Committee to review the HPAV generic solutions. The Committee completed their review and concurred with BNI's design solutions. These design solutions made provisions for venting, flushing, or draining of vessels and lines to prevent hydrogen accumulation. There were, however, a number of locations that did not lend themselves to this type of solution. For those locations, BNI proposed letting the detonation occur if the system could withstand the impact without failing. A consultant, Dominion Engineering, Inc., was retained to demonstrate through calculations that system failures would not occur due to a detonation of the hydrogen. Most major DOE concerns with the calculations have been resolved, but there are a number of open issues that BNI must still resolve.

Because of concerns with the HPAV work, ORP formed a Design Oversight Team to perform an assessment of the HPAV generic solutions. The assessment, which was completed on June 15, 2006, was primarily directed at the technical feasibility and effectiveness of the proposed generic solutions, and includes consultations with mechanical systems/mechanical design experts. In addition to confirming the technical feasibility and effectiveness, the Design Oversight Team also assessed operational/availability implications, safety/authorization basis impacts, and research and technology bases. The team reported no major findings during the exit meeting. The Design Oversight Team Report was issued in August 2006.

### **2.2.9 Alternative Ion Exchange Resin Development**

In September 2006, BNI completed preliminary testing of spherical resorcinol formaldehyde (RF) resin for qualification as an alternative to the reference SuperLig<sup>®</sup> 644 resin for removal of cesium from tank waste. The test results indicated the RF resin exceeded all requirements for cesium ion exchange and in most cases exceeded SuperLig<sup>®</sup> 644 performance. One significant

issue was the RF resin had a higher gas generation rate during accident condition exposure to hot, concentrated nitric acid. Thus, important-to-safety controls, including larger pressure relief paths, will be developed. In addition to the performance advantages, the RF resin is expected to be significantly more cost effective. Although three major tests are still underway and five final test reports have yet to be issued, the results are not expected to change BNI's recommendation that the RF resin be utilized in lieu of the SuperLig® 644. Based on a comparison of test data prepared by BNI, ORP approved spherical RF as an equivalent cesium ion exchange resin in December 2006.

### **2.2.10 Ultrafiltration System Design Review**

The EFRT raised two major issues that are consistent with ORP's 2004 design oversight conclusions for the ultrafiltration system. EFRT issue M13, Inadequate Filter Surface Area and Flux, concluded the ultrafiltration system, as originally designed, was the limiting factor in providing waste feed to the HLW and LAW melters for waste, requiring caustic leaching. EFRT issue M12, Undemonstrated Leaching Process, concluded the ultrafiltration system and leaching process have not been demonstrated beyond small scale laboratory tests.

In response to issue M13, BNI performed an engineering study to identify the maximum increase in ultrafiltration filter surface area that can be included in the WTP hot cell. BNI identified design changes that can increase the surface area by 92% utilizing five filter bundles in series for each of the two ultrafilter trains. This engineering study is planned to be finalized in early calendar year 2007. In response to issue M12, BNI is performing modeling to develop optimum ultrafiltration system operating approaches, testing tank waste samples using the optimized flowsheet, developing simulants, and testing the ultrafiltration flowsheet with an integrated engineering scale system. Initial integrated engineering scale system test results are scheduled to be available by the end of 2007.

### **2.2.11 Safety Culture**

ORP and BNI continue to work together to reinforce and improve the workforce-wide safety culture. In the past year, BNI and subcontractor workers experienced a similar number of events as last year, but the significance of events has been dramatically lowered. For example, BNI initiated a Category R type of DOE occurrence report (used for reporting recurring events) for equipment striking objects. BNI performed a Human Performance Improvement review and root cause analysis of the equipment event, and found that although relatively minor in nature and common in the construction industry, these equipment events could be avoided by developing a formal process and improving the strength of the organization. By using these low-level events to identify several areas for improvement, the organization demonstrated a commitment to continuous improvement that demonstrates an improving safety culture. Most of the improvements identified were specifically applicable to equipment movement, but one organizational weakness was identified: the use of informal implementation processes for supplemental requirements used to meet Nuclear Quality standards. Management actions to strengthen the organization should have positive impacts on WTP construction performance.

### 2.2.12 Quality Issues

**WTP Welding Program Concerns:** Since DOE raised concerns with the WTP weld program in August/September 2005, BNI has taken a number of actions to improve its welding program. BNI performed several independent reviews of the structural steel and piping welding programs and completed a root cause analysis of identified welding issues. BNI incorporated recommendations from these efforts into a corrective action report, and most of the corrective actions have been substantially completed. For example, BNI hired a new weld manager and assistant weld manager, conducted welding and pipe installation program training with more detailed training to come, and performed a detailed review of the weld control manual. After the review, BNI revised the weld control manual, conducted detailed training, and implemented the revised manual. ORP performed a program review of the revised manual and determined with minor exceptions, the manual complied with applicable welding codes and was substantially improved over the previous revision. Although implementation deficiencies are occasionally identified by both BNI and ORP, weld program implementation is acceptable at this time.

Until BNI has fully completed its corrective actions and determined they are effective, periodic peer reviews of ongoing welding program oversight and inspections by field welding engineers will continue.

BNI is investigating an issue regarding the adequacy of skewed T welds. The issue involves the size of the welds' effective throat (dimension from the centerline of the weld surface to the point where the two pieces of steel intersect). Design drawings specify the size of the fillet welds, but were not clear as to whether this was also the effective throat dimension, or if it would change depending on the angle of the steel member being welded. This issue could affect welds performed by suppliers, subcontractors, and BNI, and if undersized, could require additional welding.

**Supplier Quality:** ORP identified several issues with supplier welding and quality programs, including: (1) a supplier purchasing weld rod from an unapproved sub-supplier; (2) weld procedures that have not complied with applicable weld codes; (3) weld and inspection personnel not qualified in accordance with purchase order requirements; and (4) nondestructive examination (NDE) procedures not approved by the NDE Level III inspector. These issues, combined with issues identified over the last two years, have resulted in a number of BNI initiatives to improve supplier performance. In addition to addressing the specific issues identified, BNI recently developed a checklist containing elements derived from issues identified during ORP inspections for use by BNI Supplier Quality Representatives (SQR) at each of their suppliers. BNI developed a number of alerts requesting SQRs to perform specific quality and welding program element reviews, and implemented SQR training and enhanced management oversight. BNI also hired an experienced weld engineer to specifically review supplier weld programs.

Improvements have been noted in this area during the last six months, but issues continue to occasionally be identified.

**Commercial Grade Dedication:** During a DOE review of a commercial supplier's quality program, a number of significant issues were identified with the implementation of BNI's CGD program. This program is intended to be used to upgrade commercial grade materials and equipment for use as quality-level materials and equipment. BNI had about 30 different CGD procurement activities ongoing at the time this concern was identified. Once brought to BNI's attention, BNI performed a detailed review of their CGD program and identified a large number of issues. Initially, BNI suspended all CGD procurement activities, including shipment of any completed materials and equipment to the construction site, until corrective actions were fully developed and implemented. BNI has subsequently revised its program, procedures, and quality assurance manual to reflect requirements in American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-1, 2004, *Quality Assurance Requirements for Nuclear Facility Application*. BNI developed a review board responsible for ensuring the program adequately implements the requirements and intent of NQA-1, and released some of the in-process CDG packages. BNI continues to implement the management suspension, releasing the packages on case-by-case bases until further notice.

This quality issue is also being reviewed by the DOE Office of Enforcement for potential escalated enforcement.

**Leak Detection Boxes:** Just prior to installing PT and LAB Facilities leak detection boxes (LDB), which are designed to collect any potential leakage from process piping captured in the outer shell piping of buried coaxial pipe, it was noted some nozzle welds did not appear to have adequate weld penetration. Following installation of the boxes at the PT Facility, BNI discovered the boxes were also not designed and fabricated to the code requirements specified in the original procurement package. However, the supplier's BNI-approved drawings allowed the use of the code combination (ASME B31.1, *Process Piping*, and ASME Section VIII, *2004 ASME Boiler & Pressure Vessel Code*) to design and fabricate the LDBs.

BNI performed a review of this issue to determine how the LDBs were procured and installed. BNI found the original material requisition for the LDBs called for fabrication per ASME B31.1, which would have required a full penetration weld for these joints. During fabrication, the supplier submitted fabrication drawings and calculations to BNI to fabricate the LDBs per ASME Section VIII, which would allow for the use of partial penetration welds; BNI approved the shop fabrication drawings. Engineering has provided a disposition for the construction deficiency reports (CDR) that allows acceptance of the LDB as an unlisted device under the requirements of ASME B31.3. This approach required a stress analysis of the vessel and a pressure test of the LDB in accordance with ASME Section VIII. The construction deficiency reports were recently approved and discussed with Ecology.

**Preservation Maintenance Program:** Previously, the ORP Engineering Division listed one Finding in the BOF Property Preservation Oversight related to BNI's failure to implement programs that ensure successful government property preservation. As a result of this Finding, BNI issued a corrective action report which identifies the following corrective actions results: (1) BNI has strengthened existing procedures to develop and implement maintenance procedures for both BNI and subcontracted equipment/facilities, (2) BNI has recorded all maintenance and equipment descriptions within the various BNI databases enabling viable maintenance cards to

be generated, and (3) BNI is currently developing a property management matrix identifying standard maintenance requirements.

### 3.0 ACTIONS TAKEN OR INITIATED TO RECOVER ANY AGREEMENT SCHEDULE SLIPPAGE

#### 3.1 AFTER ACTION REPORT FINDINGS AND RECOMMENDATIONS – REPORT DATED JANUARY 2006

In 2005, the DOE Office of Engineering and Construction Management (OECM) requested an external organization, LMI Government Consulting (LMI) (a non-profit firm), to perform an after-action fact finding review of the WTP Project. OECM directed LMI to examine the period from implementation of contract modification A029 in April 2003 until late 2005. LMI documented the results of their evaluation in a January 2006 report, which focused on the causes of growth in project cost estimates and extension of schedule and weaknesses in the functional areas of staffing/organization structure; project management policies; reporting effectiveness between ORP and the DOE Headquarters; and contract management.

All LMI issues have been summarized and addressed as shown below. This is the final report for the after-action review.

- **Acquisition Management:** The accelerated award of a contract in 2000 resulted in three weaknesses: (1) an incomplete government cost analysis and basis upon which to award the contract; (2) commercial-like contract arrangements; and (3) exacerbation of vulnerabilities in a design-build approach.

**Actions and Status:** These questions were closed through the following actions: (1) DOE tasked and USACE completed an independent validation of the most recent contractor project EAC by summer 2006; (2) ORP modified the contract on November 15, 2005, to include DOE O 413.3, *Program and Project Management for the Acquisition of Capital Assets*, as a project requirement; and (3) Direction was provided to the contractor to maintain a lag of 12 months between completion of design of structures, systems, or components and the beginning of construction, which mitigates the issues with design-build contracts.

- **Accounting for Project Risk:** The contractor did not have a sound basis for a complex project involving first-of-a-kind technologies leading to an underestimation of project risk. Contributors to risk included not accounting for design of novel technologies, inadequate expectations of availability of construction materials and qualified labor, underestimating design requirements, and lack of strong technical and cost expertise in risk management.

**Actions and Status:** These questions were closed through the following actions: (1) DOE conducted several comprehensive reviews and analysis of WTP's technical approach and innovative systems; cost and schedule baselines; and risk projections. After resolution of comments from these reviews, designs are being revised and a revised cost and schedule baseline was established; (2) ORP hired a risk assessment manager to advise the ORP WTP and Hanford Site manager in the area of incorporating risk in

project and organizational activities; and (3) ORP approved a revised risk management procedure.

- **Project Management Issues:** There were several weaknesses in project management. These included: (1) premature establishment of baselines and negotiation of project milestones with regulators, given the reliance on novel technologies, (2) failure to require the contractor to comply with DOE's project management requirements, (3) reporting deficiencies in the area of EVMS and inappropriate use of the contractor's project control system data, (4) inadequate change control process, and (5) inappropriate deletion of project scope to provide additional project contingency.

**Actions and Status:** These questions were closed through the following actions: (1) DOE O 413.3 and its corresponding manual, DOE M 413.3, *Project Management for the Acquisition of Capital Assets*, were added to the contract; (2) The DOE Office of Environmental Management (OEM) is incorporating lessons learned for critical decisions in other projects and the establishment of regulatory milestones; (3) Several audits of the project's EVMS have been conducted including a certification audit in November 2006; (4) ORP issued a revised change control procedure to address deficiencies related to using contractor real-time management of project baseline; and (5) ORP has re-established project contingencies.

- **Organizational/Staffing Issues:** The report identified weaknesses in organizations and staffing: (1) ORP staff requires a larger contract administration staff with additional contracting officers, supported by additional contracting specialists, as well as a dedicated legal advisor to address contract issues; and (2) the two major projects comprising the RPP mission scope (WTP and Tank Farm Project) warrant a dedicated and certified Federal Project Director (FPD).

**Actions and Status:** These questions were closed through the following actions: (1) The following new positions have been filled: a Director of Procurement (with warrant authority), a procurement attorney, two senior experienced contracting officers (one for the WTP contract and one for the Tank Farm Project contract), two senior contract specialists, and two other contract specialists for the WTP; and (2) The Assistant Manager for Tank Farms and the Assistant Manager Waste Treatment Plant have been certified as Federal Project Directors by DOE Headquarters.

- **Contract Management Issues:** ORP contract management processes did not follow strict interpretation of DOE contract management policy, including sending direction letters to the contractor exceeding change order authorities.

**Actions and Status:** Revised correspondence procedures have been issued to prevent improper issuance of change orders.

- **Oversight Issues:** The evaluation found that there was inadequate oversight of the project on the part of Headquarters' Office of Environmental Management (EM) and Office Engineering and Construction Management (OECM) staff, and only limited oversight of the contractor by ORP based on the commercial nature of the contract.

Further, there were limited ORP and EM manager-to-staff interactions, which failed to allow either EM or OECM staff to perform functions of oversight or notify senior management of problems.

**Actions and Status:** These questions were closed through the following: (1) ORP has established and filled six Facility Representative positions, who are in the field on an almost daily basis, overseeing delivery of materials and equipment and construction activities; (2) ORP has designated technical subject matter experts in key areas related to the WTP design, engineering, and construction, such as electrical, piping, and concrete; (3) ORP has an integrated assessment schedule for monitoring contractor activities for safety and quality that it updates on a periodic basis; (4) The Assistant Secretary for Environmental Management (EM-1) has established the Office of Project Recovery, which reports to the Assistant Secretary and the Principal Deputy Assistant Secretary; and (5) DOE Headquarters' Environmental Management, Office of Performance Assessment, and OECM, as part of Quarterly Project Reviews, now provide independent assessment of the WTP Project.

- **Annual Funding Constraints:** Constrained funding pushes costs to the future and extends project schedules, resulting in an additional cost premium for work to be performed.

**Actions and Status:** The Department continues to request \$690 million per year to maintain the cost and schedule approved by the Secretarial Acquisition Executive for the December 2006 baseline.

### **3.2 ACTIONS AND STATUS: EXTERNAL REVIEW OF PROCESS FLOWSHEET – REPORT DATED MARCH 17, 2006**

DOE is requesting funds to maintain necessary progress, and an efficient and effective number of construction personnel on site.

In March 2006, the EFRT completed a critical review of the WTP process flowsheet for BNI. The team identified 17 major issues and 11 potential issues that would prevent the WTP from meeting contract capabilities. In response, BNI developed a project response plan describing the proposed actions to address the issues; IRPs were developed for each issue; and all IRPs have been issued and approved. The IRPs include the actions required for issue resolution, a schedule for completion, integration with other issues, and integration with the overall project schedule. Examples of some of the identified issues include: inadequate ultrafiltration area and flux, undemonstrated leaching process, plugging of process piping, mixing vessels erosion, inadequate mixing systems, instability of baseline ion exchange resin, PT Facility availability, lack of comprehensive feed testing in commissioning, and limited remotability demonstration. Issue resolution has focused on near-term project impacts. Resolution of all issues, with additional analysis and testing, is planned to be completed by the fall of 2008.

### 3.3 CONGRESSIONAL INTERACTIONS

DOE prepares quarterly reports to House and Senate Committees on Authorization and Appropriations on the activities and financial status of each of the five subprojects within the WTP Project.

### 3.4 SUMMARY

In summary, DOE and its contractor are working to resolve issues raised by various review teams in order to successfully complete this project and begin plant operations. DOE continues to evaluate all of the major project management systems, project controls, business systems, and technical processes.

### 4.0 BUDGET AND COST STATUS

**Status:** In the June 2006 cost and schedule performance reports and earned value reporting data, BNI implemented the May 2006 EAC as an over-target baseline, pending DOE approval as the new performance baseline (approved on December 22, 2006). In the October 2006 performance reports, BNI incorporated a resequencing effort to continue construction of the LAW, LAB, and BOF (LBL), while delaying construction restart of PT and HLW until October 2007. Through November 2006, the WTP Project has a cumulative negative schedule variance of \$9.4 million and a positive cost variance of \$29.6 million on \$3,317 million of completed work to date. Much of the positive cost variance is primarily attributed to proficient productivity by construction field craft in the PT and HLW Facilities prior to the work curtailment in FY 2005.

**Budget:** The WTP Project received \$520.7 million of FY 2006 funding, which was divided into separate control accounts for each of the five main facilities. The WTP Project spent \$517.2 million during FY 2006, which left committed carryover funds of \$250.3 million. The carryover funds were either committed by BNI to a subcontract or needed for BNI termination liability. For FY 2007, the Congressional Budget request included \$690 million for the WTP Project. As of this report, the Project is still under a Congressional Continuing Resolution for FY 2007.

**Costs:** Anticipated spending for FY 2007, based on BNI's October cost and schedule performance reports, is about \$620 million, not including contingency use or fee payments.

### 5.0 DOE/DOE CONTRACTOR COMPLIANCE

The new performance baseline, which was approved on December 22, 2006, included a cost of \$12.263 billion and completion date of November 2019 for the WTP Project. The cost to complete the project is \$8.62 billion and the project has already been appropriated \$3.64 billion for design and construction. This December 2006 baseline assumes consistent Congressional appropriations of \$690 million from FY 2007 through construction and commissioning completion.

Now that the revised WTP cost and schedule has been approved by DOE's Secretarial Acquisition Executive, discussions can proceed with the regulators to try to resolve the HFFACO and RCRA permit schedule issues (refer to Table 3 for a listing of affected milestones).

**Table 3. Impacted HFFACO Milestones**

Milestone	HFFACO Date	Description
M-062-00	12/31/2028	Complete Pretreatment Processing and Vitrification of Hanford High Level (HLW) and Low Activity (LAW) Tank Wastes.  Compliance with the work schedules set forth in this M-62 series is defined as the performance of sufficient work to assure with reasonable certainty that DOE will accomplish series M-62 major and interim milestone requirements.
M-062-00A	02/28/2018	Complete WTP Pretreatment Processing and Vitrification of Hanford HLW and LAW Tank Waste.  Tank Waste processing shall complete the WTP pretreatment and vitrification of no less than 10% of Hanford's Tank waste by mass and 25% by activity.
M-062-07B	12/31/2007	Complete Assembly Of Low Activity Waste Vitrification Facility Melter #1 So That It Is Ready For Transport And Installation In The LAW Vitrification Building (BNI Baseline Schedule Activity 4DL321A200 As Part Of DOE Contract No. DE-AC27-01RV14136).
M-062-08	06/30/2006	Submittal Of Hanford Tank Waste Supplemental Treatment Technologies Report, Draft Hanford Tank Waste Treatment Baseline, And Draft Negotiations Agreement In Principle (AIP).  DOE will submit a supplemental Treatment Technologies Report that describes the technical, financial, and contractual alternatives which, in combination with the WTP and any required additional LAW vitrification facilities, are needed to treat all of Hanford's Tank Wastes.
M-062-09	02/28/2009	Start Cold Commissioning - Waste Treatment Plant.  DOE Will Start Cold Commissioning Of Its Tank Waste Treatment Plant. Start Of Cold Commissioning Is Defined As Introduction Of First Feed Simulant Into A Process Building.
M-062-10	01/31/2011	Complete Hot Commissioning - Waste Treatment Plant.  DOE Will Achieve Sustained Throughput Of Pretreatment, Low-Activity Waste Vitrification And High-Level Waste Vitrification Processes, And Demonstrate WTP Treatment Complex Availability To Complete Treatment of no less than 10% of the tank waste by mass and 25% of the tank waste by activity by December 2018.
M-062-11	06/30/2007	Submit A Final Hanford Tank Waste Treatment Baseline.  Following The Completion Of Negotiations Required In M-62-08, DOE Will Modify Its Draft Baseline As Required And Submit Its Revised Agreed-To Baseline For Treating All Hanford Tank Waste (HLW, LAW, and TRU) by 12/31/2028.

## **6.0 AREAS OF NON-COMPLIANCE**

The WTP portion of the RCRA permit includes a compliance schedule for the submittal of permit design packages. The following six compliance schedule items were not completed as scheduled in Attachment 51, Appendix 1 of the RCRA permit:

1. Item 18, "Submit engineering information for secondary containment and leak detection system for the Pretreatment Plant Miscellaneous Unit Systems," due October 30, 2006.
2. Item 23, "Submit engineering information for LAW Vitrification Miscellaneous Treatment Unit sub-system," due August 18, 2006.
3. Item 26, "Submit LAW Vitrification Environmental Performance Demonstration Test Plan for Ecology review and approval," due October 2, 2006.
4. Item 31, "Submit HLW Vitrification Environmental Performance Demonstration Test Plan for Ecology review and approval," due October 2, 2006.

## 7.0 STATUS OF HFFACO MILESTONES

The HFFACO milestones for WTP, the M-62 milestone series that were completed during this reporting period or are outstanding, are listed below with full text and status as of this report.

### 7.1 M-62-00 – Complete PT Processing and Vitrification of Hanford High Level and Low Activity Tank Wastes

**Milestone Date:** December 31, 2028

**Description:** Compliance with the work schedules set forth in this M-62 series is defined as the performance of sufficient work to assure with reasonable certainty that DOE will accomplish series M-62 major and interim milestone requirements.

DOE internal work schedules (e.g., DOE approved schedule baselines) and associated work directives and authorizations shall be consistent with the requirements of this agreement. Modification of DOE contractor baseline(s) and issuance of associated DOE work directives and/or authorizations that are not consistent with agreement requirements shall not be finalized prior to approval of an agreement change request submitted pursuant to agreement action plan, Section 12.0.

**Status:** Unrecoverable.

### 7.2 M-62-00A – Complete WTP PT, Processing and Vitrification of Hanford HLW and LAW Tank Wastes

**Milestone Date:** February 28, 2018

**Description:** Tank waste processing shall complete the WTP pretreatment and vitrification of no less than 10% of Hanford's tank waste by mass\* and 25% by activity.

\*[In meeting this requirement DOE will pretreat and vitrify no less than 6,000 metric tons of sodium (in the instance of LAW feed) and 800 metric tons of waste oxides (in the instance of HLW feed)].

**Status:** Unrecoverable.

### 7.3 M-62-03 – Submit DOE Petition for RCRA Delisting of Vitrified HLW

**Milestone Date:** December 31, 2006

**Description:** DOE will submit its petition for delisting of the immobilized high-level waste from the WTP from RCRA and the Washington State "Hazardous Waste Management Act" (delisting petition) in accordance with Title 40 *Code of Federal Regulations* (CFR) 260.22 and *Washington Administrative Code* (WAC) 173-303-072.

**Status:** Complete

- 7.4 M-62-07B – Complete Assembly of LAW Melter #1 so that it is ready for transport and installation in the LAW vitrification building (BNI baseline schedule activity 4DL321A3200 as part of DOE Contract No. DE-AC27-01RV14136), and complete schedule activity ID 4DH46102A2 – Move #1 melter into the HLW vitrification facility.**

**Milestone Date:** December 31, 2007

**Description:** This milestone represents (1) the assembly of LAW Melter #1 to the point it is ready for refractory as part of BNI baseline activities 3EL3212A00 “Specifications and Analysis,” 4DL321A000 “LAW - Procure Material & Equipment for Melters,” and 4DL321A200 “LAW- Assemble Melter #1,” (Contract No. DE-AC27-01RV14136). In addition, activities 4DL121U100 “LAW - Elev +3 South Melter FREP,” and 4DL131D000 “LAW - Elev +28 Columns, Beams & Q-Decking at +48,” shall be substantially completed; and (2) moving the first HLW melter into the HLW Facility as defined in BNI baseline activities ID 4DH46102A2.

Completion of this milestone will be met when (1) LAW melter #1 will have been fully fabricated, assembled, and ready for refractory material to be installed. Assembly of the melter is scheduled to occur near the end of LAW construction when the facility is most ready to have the assembled melter moved into the LAW cell where the refractory material will be installed. Meeting this milestone therefore represents significant accomplishment of the engineering, design, and construction of the LAW Facility; and (2) HLW melter #1 has been fully fabricated and moved into the HLW Vitrification Facility.

**Status:** Unrecoverable.

- 7.5 M-62-08 – Submittal of Hanford Tank Waste Supplemental Treatment Technologies Report, Draft Hanford Tank Waste Treatment Baseline, and Draft Negotiations Agreement in Principle (AIP).**

**Milestone Date:** June 30, 2006

**Description:** DOE will submit a supplemental treatment technologies report that describes the technical, financial, and contractual alternatives, which in combination with the WTP and any required additional LAW vitrification facilities, are needed to treat all of Hanford’s tank wastes. The report will identify and describe viable path(s) forward to complete treatment of all tank wastes by December 31, 2028. The report shall apply the same selection criteria to all options and include the second LAW vitrification facility as an option. The report will include the results of all waste form performance data (compared against the performance of borosilicate glass) for all the treatment technologies being considered; performance data will be adequate to make decisions as to the acceptability of any proposed waste form for the waste being considered; and description of the considered treatment technologies (including size, throughput, technical viability, and life cycle cost estimates).

This report will also include a discussion of waste treatment plant throughput commitments and the realistic potential for enhancing the throughput of currently planned melters, proposed additional melters and potential second generation melters installed at first melter change out.

The draft baseline will contain DOE's proposed approach for treating all Hanford Site tank wastes (high-level, low-activity, and transuranic) by December 31, 2028, including life-cycle cost estimates that indicate projected funding requirements through completion of the RPP mission; a schedule for construction and operation of proposed new facilities and/or enhancements to the WTP; and projected throughput for each facility.

The report and baseline will be accompanied by a draft negotiations agreement in principle (AIP) and draft agreement change request containing milestones and associated agreement requirements sufficient to effectively drive all required work. These, include but are not limited to: (1) the establishment of requirements regarding any necessary WTP modification(s); (2) the establishment of requirements scheduling the acquisition and operation of any approved treatment technology systems; (3) the establishment of production metrics for treatment complex (WTP plus any supplemental treatment system or second LAW vitrification facility) consistent with completion of treatment by December 31, 2028; and (4) the establishment of requirements scheduling acquisition and operation of feed delivery systems for any approved supplemental technology (M-47 milestones). The AIP will be finalized within 30 days of submittal and provide for negotiations to be completed within 180 days of AIP finalization, and will provide that, in the event the parties do not reach agreement within this timeframe, the negotiations will be resolved as a resolution of a dispute via final determination of the Director of Ecology pursuant to HFFACO Article VIII. Unless otherwise agreed by the parties, this final determination will be issued within seven months of AIP finalization.

**Status:** Missed. Milestone M-62-08 was missed, due to (1) lack of supplemental technology process design and cost information that was to have been obtained from the Demonstration Bulk Vitrification System (DBVS) project; and (2) lack of information on enhancements to the WTP, including a second LAW vitrification facility.

#### **7.6 M-62-09 - Start Cold Commissioning - Waste Treatment Plant**

**Milestone Date:** February 28, 2009

**Description:** DOE will start cold commissioning of its tank waste treatment plant. Start of cold commissioning is defined as introduction of first feed simulant into a process building.

**Status:** Unrecoverable.

#### **7.7 M-62-10 - Complete Hot Commissioning - Waste Treatment Plant**

**Milestone Date:** January 31, 2011

**Description:** DOE will achieve sustained throughput of PT, LAW vitrification, and HLW vitrification processes and demonstrate WTP treatment complex availability to complete

treatment of no less than 10% of the tank waste by mass and 25% of the tank waste by activity by December 2018.

**Status:** Unrecoverable.

#### **7.8 M-62-11 - Submit A Final Hanford Tank Waste Treatment Baseline**

**Milestone Date:** June 30, 2007 (See M-62-10)

**Description:** Following the completion of negotiations required in M-62-08, DOE will modify its draft baseline as required and submit its revised, agreed-to, baseline for treating all Hanford tank waste (high-level, low-activity, and transuranic) by December 31, 2028.

**Status:** Unrecoverable.

## 8.0 REFERENCES

- 05-WED-054, CCN 134669, "Design Oversight Report for the Revised Hydrogen Generation Rates [HGR] and Times to Lower Flammability Limit [LFL] Calculation [24590-WTP-M4C-V11T-00004] letter to Bechtel National, Inc., U.S. Department of Energy, Office of River Protection, Richland, Washington, dated January 12, 2006.
- 62 FR 8693, 1997, "Record of Decision for the Tank Waste Remediation System, Hanford Site, Richland, WA," *Federal Register*, Vol. 62, pp. 8693-8704, February 26.
- ASME 2004, *NQA-1 - 2004 Quality Assurance Requirements for Nuclear Facility Applications (QA)*, American Society of Mechanical Engineers, International, New York, New York.
- ASME B31.3, 2004, *Process Piping*, American Society of Mechanical Engineers, New York, New York.
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- Calculation of Hydrogen Generation Rates and Times to Lower Flammability Limit for WTP*, 24590-WTP-M4C-V11T-00004, Rev. C, dated May 18, 2006.
- CCN 106655, "Hydrogen Generation Rate Calculation Open Items, letter to U.S. Department of Energy, Office of River Protection, Bechtel National, Inc., Richland, Washington, dated March 14, 2006.
- DNFSB 2005, letter to Samuel W. Bodman, Secretary of Energy, U.S. Department of Energy, Washington, D.C., from A.J. Eggenberger, Chairman, Defense Nuclear Facilities Safety Board, Washington, D.C., dated October 15, 2005.
- DOE Contract No. DE-AC27-01RV14136 between the U.S. Department of Energy and Bechtel National, Inc., dated December 11, 2000.
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- Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq., as amended.
- SRS 2006, *Ultrafiltration Process (UFP) Caustic Leaching Antifoam Performance*, WSRC-TR-2005-00564, Rev. 0, Savannah River National Laboratory, Aiken, South Carolina.